BARITE

By Joyce A. Ober

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Domestic production of barite increased more than 53% to 445,000 metric tons, while the value increased about 20% to $15.9 million. Barite production has remained relatively stable for the past 4 years except for a marked decrease in production in 1989. Although imports remained greater than domestic production, domestic barite comprised a larger share of total U. S. consumption than had been the case for several years. Production from Nevada, the leading producing State, increased about 62%. Imports for consumption of crude barite remained about the same, and ground barite imports increased 22%. Imports of barite exceeded domestic production for the ninth consecutive year, but the import figure of 988,000 tons for 1990 was about 1.1 million tons below the record-high tonnage of 1982. Ground barite imports, except for the drilling boom years of the late 1970's and early 1980's, have been negligible. The principal use for barite, as a weighting agent in oil- and gas-well-drilling fluids (muds), accounted for more than 92% of U.S. consumption. Chemical, glass, and filler and/or extender uses accounted for the remainder.

The Iraqi invasion of Kuwait on August 2, 1990, caused oil prices to rise within days of the invasion. Concern over a stable oil supply prompted U.S. oil companies to increase drilling activity. Total world supplies were not significantly effected because of increased oil production in Saudi Arabia. Oil prices decreased after the initial spike with the stabilization of supply, but did not return to the lower preinvasion prices.

TABLE 1

SALIENT BARITE AND BARIUM CHEMICAL STATISTICS

(Thousand metric tons and thousand dollars)

	1986	1987	1988	1989	1990
United States:					
Barite, primary:					
Sold or used by producers	269	406	404	290	445
Value	$12,326	$15,810	$15,512	$12,625	$15,853
Exports	7	9	(1)	10	9
Value	$1,021	$716	$353	$1,622	$1,675
Imports for consumption (crude)	676	748	1,132	987	988
Consumption (apparent)[2]	939	1,147	1,536	1,271	1,424
Crushed and ground (sold or used by processors)[3]	1,103	1,301	1,612	1,277	1,434
Value	$75,965	$108,759	$127,373	$103,759	$123,836
Barium chemicals (sold or used by processors)	25	28	27	e30	W
Value	$16,871	$16,466	$15,284	e17,000	W
World: Production	r4,688	r4,712	r5,472	r5,577	e5,577

eEstimated. rRevised. W Withheld data to avoid disclosing company proprietary data.
[1]Less than 1/2 unit.
[2]Sold or used plus imports minus exports.
[3]Includes imports.

DOMESTIC DATA COVERAGE

Domestic production data for barite are developed by the U.S. Bureau of Mines from a voluntary survey of U.S. operations. Of the 65 operations to which a survey request was sent, all responded, representing 100% of the total crushed and ground production sold or used shown in table 1.

BACKGROUND

Definitions and Specifications

The term "primary barite," as used in this report, refers to the first marketable product and includes crude barite, flotation concentrate, and other beneficiated material such as washer, jig, heavy media, table, or magnetic separation concentrate. Most primary barite requires fine grinding before it is used for drilling muds. This grinding may or may not be done at the mine site.

Barite is the mineralogical name for barium sulfate and was derived from the Greek word "barus," meaning heavy. In commerce, the mineral is often referred to as "heavy spar" or "barytes."

Specifications for barite vary according to different uses. Material for weighting muds must be finely ground, dense, and chemically inert; consequently, barite for this purpose must have a specific gravity of 4.2 or higher, it must be free of soluble salts, and 90% to 95% of the material must pass through a 325-mesh screen.

TABLE 2

PRODUCERS OF BARIUM MATERIALS IN 1990

Company	Plant location	Material
BARITE		
American Minerals Inc.	Camden, NJ	Filler amd well drilling.
Do.	Rosiclare, IL	Do.
Baroid Drilling Fluids Inc.	Fountain Farm, MO	Do.
Do.	Lake Charles, LA	Do.
Do.	New Orleans, LA	Do.
Circle A Construction Co. Inc.	Wells, NV	Primary and filler.
Custom Milling & Supply Co.	Salt Lake City, UT	Well drilling.
Cyprus Industrial Minerals Co.	Cartersville, GA	Primary and ground.
De Soto Mining Co. Inc.	Richwoods, MO	Primary
Extender Products Ltd.	Mineral Point, MO	Filler.
General Barite Co.	Washington, MO	Primary.
GEO International Inc.	Florin, CA	Do.
International Drilling Fluids	Amelia, TX	Well drilling.
J. M. Huber Corp.	Quincy, IL	Do.
M I Drilling Fluids	Battle Mountain, NV	Do.
Do.	Brownsville, TX	Well drilling and filler.
Do.	Galveston, TX	Well drilling.
Do.	Lander, NV	Primary and ground.
Do.	New Orleans, LA	Well drilling.
Do.	West Lake Charles, LA	Well drilling and filler.
Do.	Ross, NV	Primary
Milpark Drilling Fluids	Argenta, NV	Primary and ground.
Do.	Corpus Christi, TX	Do.
Do.	Galveston, TX	Do.
Do.	New Orleans, LA	Do.
The Milwhite Co. Inc.	Brownsville, TX	Well drilling and filler.
Do.	Bryant, AK	Do.
Do.	Houston, TX	Well drilling.
Harcros Pigment Inc.	East St. Louis, IL	Filler.
Mountain Minerals Co., Ltd.	Missoula, MT	Primary and ground.
New Riverside Ochre Co.	Cartersville, GA	Primary.
Old Soldiers Minerals Ltd.	Abbeville, LA	Well drilling.
Do.	Elk City, OK	Do.
Ozark-Mahoning Co.	Rosiclare, IL	Primary.
Standard Industrial Minerals	Laws, CA	Filler.
Standard Slag Inc.	Nye, NV	Do.
A.J. Smith Mines Co.	McMinn, TN	Primary
BARIUM COMPOUNDS		
J.T. Baker Chemical Co.	Phillipsburg, NJ	Chemicals.
Chemical Products Corp.	Cartersville, GA	Do.

A small percentage of iron oxide is not objectionable. In chemical manufacturing, purity is the principal concern, and a maximum of 1% each of ferric oxide (Fe_2O_3) and strontium sulfate ($SrSO_4$) and a trace of fluorine usually are specified, with a minimum of 94% barium sulfate ($BaSO_4$). If the mineral is to be used in the production of lithopone, the $SrSO_4$ content may be somewhat higher. Mesh size is important to chemical manufacturers; if the material is too fine, dust is lost, and if it is too coarse, mixing with carbonaceous material is poor. Most chemical manufacturers specify a size range of 4 to 20 mesh; some purchase lump barite and grind it to their own needs.

Glass manufacturers usually require a minimum of 95% $BaSO_4$ with a maximum of 2.5% silicon dioxide (SiO_2) and 0.15% Fe_2O_3. The particle size range generally preferred is minus 30 to plus 140 mesh. Fine-ground barite can be substituted when crushed material is not available.

Products for Trade and Industry

The principal use for barite, as a weighting material in well-drilling muds, accounted for more than 92% of total U.S. consumption in 1990. Drilling muds have five main functions: (1) to transport drill cuttings to the surface, (2) to control formation pressures, (3) to maintain borehole stability, (4) to protect producing zones, and (5) to cool and lubricate the bit and drill string. The principal function of the barite constituent is as a weighting agent to suppress high formation pressures and prevent blowouts. As the well is drilled, the bit passes through various formations, each with different characteristics. The deeper the hole, the more barite is needed as a percentage of the total mud mix.

The use of barite as a filler or extender and other uses accounted for about 7% of total U.S. consumption in 1990. Barite has a high specific gravity, low oil absorption, easy wettability by oils, and good sanding qualities. Unbleached barite may be substituted for bleached barite when brightness is not a factor. In painting automobiles, barite is used as a filler for the primer coats. The barite contributes to the gloss of the topcoat. When the primers are applied by the electrodeposition process, the body structure is dipped into a tank containing water and paint primer. The method eliminates one of the primary coats, thus reducing the quantity of barite used.

Barite is also used as a filler or extender in some plastic and rubber products. Processors of polyurethane foam use barite in manufacturing such products as floormats and carpet-backings to increase density and improve processing qualities. Barite is used in white sidewalls for tires; sidewalls consist mainly of rubber, zinc oxide, and a small quantity of barite.

Other industries use small quantities of barite fillers. In the paper industry, the white and dense barite coatings serve as a base for the sensitized layers in photographic prints. In the printing industry, barite is used in inks.

In glassmaking, barite is added to the glass melt to flux the heat-insulating froth that forms on the melt surface, thus saving fuel, and to act as an oxidizer and decolorizer, making the glass more workable and increasing its brilliance.

Minor uses include ballast for ships, heavy concrete aggregate for radiation shielding and pipe-weighting in low-lying areas, and applications in foundries.

Barite is also a raw material for barium chemical manufacturing. The major barium chemicals are the carbonate, chloride, oxide, hydroxide, nitrate, peroxide, and sulfate.

The most important barium chemical is precipitated barium carbonate, which is a raw material for production of many of the other compounds. It is also used in brick and tile manufacturing to control scum caused by gypsum or magnesium sulfate in the clay and to diminish porosity and prevent discoloration in brick. Other uses are in television picture tubes, optical glass, ceramic glazes, porcelain enamel, ferrites, and miscellaneous ceramic products.

Blanc fixe, chemically precipitated barium sulfate, is used as a white filler in paints, rubber, inks, and other materials where a degree of purity higher than natural barite is required. Lithopone (a white pigment composed of a mixture of barium sulfate, zinc sulfide, and zinc oxide), formerly manufactured in large tonnages for use as a white pigment in paints, has been largely replaced by titanium dioxide.

Barium chloride is used in case-hardening and heat-treating baths, in leather and cloth, in making magnesium metal, in preventing scum on brick, in water treatment, and as a laboratory reagent. Fused barium chloride may be electrolyzed to produce barium metal.

Barium metal is also produced by reduction of barium oxide. The metal is used as a "getter" to remove traces of gas from vacuum tubes or in alloys for spark plugs and electronic emission elements in electronic tubes.

Barium nitrate is used in green signal flares, tracer bullets, primers and detonators, and enamels. Barium oxide is used in electric furnace ferrous metallurgy to increase the life of acid furnace linings, to give a quieter and steadier arc, to reduce the sulfur content of the iron, and to lower the slag viscosity.

Barium hydroxide prevents scumming in ceramics and is used in lubricating oils and to recover sugar from molasses by the barium saccharate process. Barium titanate finds use in miniature electronic and communication equipment.

Industry Structure

Domestic barite production began in 1845 in Fauquier County, VA. About 5 years later, production began in Missouri. In 1880, Tennessee became the third barite-producing State, and 1901 and 1903 saw Georgia and Kentucky, respectively, become producers. California began producing in 1914, Nevada in 1916, and Arkansas in 1941.

Barite was first used as a filler in white paints; however, in 1842, with the advent of the domestic lithopone industry, a second important market opened. In 1908, Chicago Copper Refining Co. (now Chicago Copper & Chemical Co.) began manufacturing barium chemicals at Blue Island, IL. The first washers and jigs used in the industry were installed in Georgia and Tennessee in 1914-16 and in Missouri in 1923–24. A fourth market for barite came into existence in 1916 when a patent was obtained on the use of barite as a weighting agent in rotary drilling muds; today this is the largest consumer of barite. In 1941, the deposit of barite at Malvern, AK, was opened when Magnet Cove Barium Corp. successfully separated barite from associated minerals by flotation. In 1977, IMCO Services Co. completed a multimillion dollar plant at Mountain Springs, NV, that produced barite concentrate using jigs, concentration tables, and flotation. This combination of beneficiating methods was unique in the barite industry.

Geology

Barite is the only commercial source of barium and barium compounds. Witherite ($BaCO_3$) has been produced from the Settlingstones Mine in England, and small quantities enter the United States every year.

Pure barite has a specific gravity of 4.5. Barite varies considerably in appearance depending on source and treatment. It is a moderately soft crystalline material with a Mohs' hardness between 3 and 3.5. In residual deposits, it ranges in size from large boulders to fines. Shades of white to dark gray and black, depending on impurities and surficial coating, are common in commercial deposits.

Vein and cavity-filling deposits are those in which barite occurs along faults, joints, bedding planes, and other solution channels or sink structures. These deposits are found most often in limestone. Most of the vein deposits are believed to be of hydrothermal origin.

In central Missouri, barite occurs in circular deposits in karst or collapse and sink structures. These ores are rich, but the deposits are generally small in overall extent. These deposits are also important as the source of the residual ore upon weathering.

Residual barite deposits are formed by the weathering of preexisting deposits. The principal residual deposits are found in southeastern Missouri; the Appalachian region; Sweetwater, TN; Cartersville, GA; and in the Rio Grande area of Texas. A concentration of at least 100 to 300 pounds of barite per cubic yard is required in a commercial deposit. In Washington County, MO, the residuum is 10- to 15-feet thick, while in Cartersville, GA, the ore is 150-feet thick in some spots. This form of deposit has been of considerable economic significance.

The most important commercial deposits are of bedded barite. These are principally in Arkansas, California, and Nevada.[1] The barite in these areas is generally dark gray to black and has a characteristic fetid odor when struck with a hammer. The beds, which vary in thickness from several inches to more than 50 feet, occur interbedded with dark chert and siliceous siltstone and shale. In most of the deposits, the barite is laminated. In some areas, barite nodules and rosettes make up a large part of the beds. Many of the beds contain 50% to 95% barite. Originally it was thought that these deposits were the result of the replacement of carbonate rocks; however, current thought is that the deposits are of sedimentary origin. The actual environment of deposition has not been established, but theories range from submarine volcanic emissions to hydrothermal solutions to recycling of barite from preexisting rocks.

Technology

Exploration.—In the past two decades, geological exploration has led to the discovery of bedded barite deposits in

Canada, India, Mexico, and the United States. Bedded deposits have not been sought in many parts of the world. As the search for barite expands in the coming years, it is likely that more bedded deposits will be discovered.

Mining.—Residual deposits of barite are generally mined by draglines in open pits after removal of overburden by conventional methods using elevating scrapers, trucks, dumpers, bulldozers, and front-end loaders. The ore is then beneficiated in washer plants equipped with rotary breakers, log washers, trommel screens, and jigs to separate barite from other material. Fine barite in the overflow from the log washers is recovered by tabling and flotation, while the jig concentrate is magnetically separated.

Bedded and vein deposits may be mined by open pit or underground methods depending on local conditions. The bedded deposits of Arkansas have been mined by both methods. The ore is crushed and ground for beneficiation by flotation. Bedded barite in Nevada is mined by open pit methods using a combination of bulldozers with ripping teeth and conventional blasting. The ore is picked up by front-end loaders and hauled in dump trucks to a processing plant. In some deposits, the ore is of sufficient grade to be either screened and direct shipped or washed, crushed, screened, and shipped to a grinding plant; however, much of the ore requires beneficiation by jigging or flotation.

Quantities of barite have been recovered by underwater mining off Castle Island near Petersburg in southeastern Alaska. The ore is blasted, recovered by a crane equipped with a special digging bucket, and loaded into barges.

Processing.—Barite grinding is usually accomplished by heated airswept Raymond mills, a type of roller mill; however, ball mills are used when iron contamination is not important, as in drilling muds. Barite is ground either wet or dry. For use in well drilling, barite is ground dry; if it requires upgrading by flotation, it is ground wet. Barite is ground wet when it is to be bleached for filler use; impurities are subsequently removed by treatment with sulfuric acid. The bleached barite pulp is then settled and separated, washed, dried, sized, and bagged.

Barite is converted into an intermediate soluble form before its use in the manufacture of lithopone. Crushed barite is roasted with coke in a kiln at about 1,200° C to reduce the barium sulfate to the more soluble compound, barium sulfide, commonly called black ash. The sulfide is leached from the clinker with hot water.[2] By adding zinc sulfate to the leach liquor, an intimate mixture of barium sulfate and zinc sulfide called lithopone is precipitated.

The leach liquor is also a precursor of a number of barium chemicals. Addition of sodium sulfate precipitates barium sulfate (called blanc fixe). Barium carbonate is precipitated by either carbonating or adding sodium carbonate to the leach liquor. Hydrochloric acid added to the leach liquor produces a solution of barium chloride. Barium carbonate and barium chloride are the starting compounds for the manufacture of many other barium chemicals.

ANNUAL REVIEW

Production

Run-of-mine barite, the lowest cost primary barite sold or used by producers, representing 70% of total production, increased more than 140% in 1990. The remainder was flotation concentrate and other beneficiated material. The lower cost crude barite and jigged beneficiated materials were used chiefly in drilling muds; the higher valued floated and other beneficiated material was used mostly in chemical and glass manufacturing and in filler applications.

Reported primary production increased approximately 53% from 290,000 in 1989 to 445,000 tons. Nevada and Georgia remained the two leading barite-producing States. Other producing States, in descending order, were Missouri, California, Tennessee, Illinois, and Montana. Illinois production was as a coproduct of fluorspar mining and milling; in all other States, barite is the primary product.

The leading domestic barite producers were M-I Drilling Fluids Co. with mines in Nevada, a Dresser-Halliburton Co.; Milpark Drilling Fluids, a Baker Hughes Inc. company also with mines in Nevada; and Baroid Drilling Fluids Inc., a division of NL Petroleum Services Inc., with mines in Missouri and Nevada.

TABLE 3

U.S. PRIMARY BARITE SOLD OR USED BY PRODUCERS, BY STATE

State	Number of operations	Run of mine		Beneficiated material		Total	
		Quantity (thousand metric tons)	Value (thousands)	Quantity (thousand metric tons)	Value (thousands)	Quantity (thousand metric tons)	Value (thousands)
1989:							
Nevada	5	122	$1,869	87	$1,603	209	$3,473
Other States	8	3	177	78	8,975	81	9,152
Total	13	125	2,046	165	10,578	290	[1]12,625
1990:							
Nevada	6	294	5,116	44	768	338	5,884
Other States	8	17	1,056	91	8,913	108	9,969
Total	14	311	6,172	135	9,681	[1]445	15,853

[1]Data may not add to totals shown because of independent rounding.

TABLE 4

CRUSHED AND GROUND BARITE[1] SOLD OR USED BY PROCESSORS IN THE UNITED STATES, BY STATE

State	1989			1990		
	Number of plants	Quantity (thousand metric tons)	Value (thousands)	Number of plants	Quantity (thousand metric tons)	Value (thousands)
Louisiana	7	700	$50,533	7	700	$56,895
Missouri	1	W	W	2	W	W
Nevada	3	97	6,208	3	144	9,680
Oklahoma	2	W	W	1	W	W
Texas	4	313	27,288	7	388	33,905
Other[2]	14	167	19,730	19	202	23,356
Total	31	1,277	103,759	39	1,434	123,836

W Withheld to avoid disclosing company proprietary data; included with "Other."
[1]Includes imports.
[2]Includes Arkansas, California, Georgia, Illinois, New Jersey, and Utah.

Oil prices remained volatile throughout the year, but trends were to higher prices even before the Iraqi invasion of Kuwait. Drilling activity had risen somewhat before the invasion, and the higher prices experienced after the invasion prompted even more domestic drilling and an increase in demand for barite. Oil prices are expected to remain higher than they had been prior to the evasion after the problems in that part of the world are resolved. The invasion renewed concern over the U.S. energy dependence, leading to additional oil exploration and renewed interest in the development of alternative fuels.

Consumption and Uses

Consumption of crushed and ground barite increased about 11%, from 1.3 million tons in 1989 to 1.4 million tons in 1990. The oil- and gas-well-drilling industry completed more than 22,000 wells and drilled nearly 113 million feet of hole;[3] these figures were 8% and 11% higher, respectively, than those in 1989. The relationship between barite production, consumption, and well drilling is illustrated in figure 1.

Total drilling footage exceeded 6 million feet in four States: Texas, 42.1 million feet; Oklahoma, 12.7 million; Louisiana, 9.1 million; and Kansas, 7.1 million. Generally, the deeper a hole is drilled, the more barite is used per foot of drilling. Among the four leading States, Louisiana had the highest average well depth, about 7,100 feet, and Kansas the shallowest, about 3,500 feet. Wyoming, absent from the top States this year in well footage drilled and the perennial leader in the highest average well depth, recorded an average well depth of about 7,200 feet. The U.S. average increased slightly to about 5,000 feet. Barite consumption increased accordingly with the 8% increase in the number of wells drilled as well as the slight increase in average well depth. There was little change in the amount of barite used per foot of drilling, from 11.52 kilograms in 1989 to 11.76 kilograms in 1990.

Another barometer of drilling activity, the Baker Hughes rig count, showed the average number of operating domestic rigs in 1990 increased about 17% to 1,010.[4]

Prices

Price quotations in trade publications for barite remained unchanged. These prices may serve as a general guide, but do not reflect actual transactions.

The reported average value per ton of domestic barite, based on reported value of direct-ship, beneficiated, and floated material, decreased about 18%, f.o.b. plant, from $43.53 per ton in 1989 to $35.63. This decrease in value for domestic concentrate is attributed to a larger percentage of lower valued drilling-mud-grade material in the total. The average value of ground barite, sold or used by producers, was $86.36 per ton, a 6% increase from the $81.25 per ton reported in 1989. The average customs value of exported barite was $181.53 per ton.

Foreign Trade

Exports of natural barium sulfate or barite decreased about 5%, from about 9,700 tons to about 9,200 tons. Exports were still significantly lower than the record high of 109,000 tons in 1979. Export and import data provided by the Bureau of the Census did not indicate the grades of barite traded; however, based only on the value of individual shipments, from about $75 to about $5,000 per ton, drilling-, pharmaceutical-, chemical-, filler-, and glass-grade were all exported. Historically, barite exports were predominantly ground drilling-mud-grade material with less than 5% of the tonnage specialty ground barites. Canada and Mexico have been traditionally either first or second among export recipients of U.S. ground barite; these two major oil-producing countries accounted for about 75% of the total exports.

Imports for consumption of crude barite remained about the same as they were in 1989, at about 1 million tons. The 1990 barite import figure was approximately 50% below the record high of 2.32 million tons set in 1982. The c.i.f. value of this material averaged $41.61 ton, slightly higher than that in 1989. The principal source countries, in descending order, were China, with an average value of $41.33; India, $34.94; and Peru, $37.08. The higher priced material was chiefly crude filler and extender-quality barite. High-quality barite, generally material with a specific gravity greater than 4.2, is usually blended during grinding with lower

FIGURE 1

BARITE CONSUMPTION AND NUMBER OF OIL AND GAS WELLS DRILLED

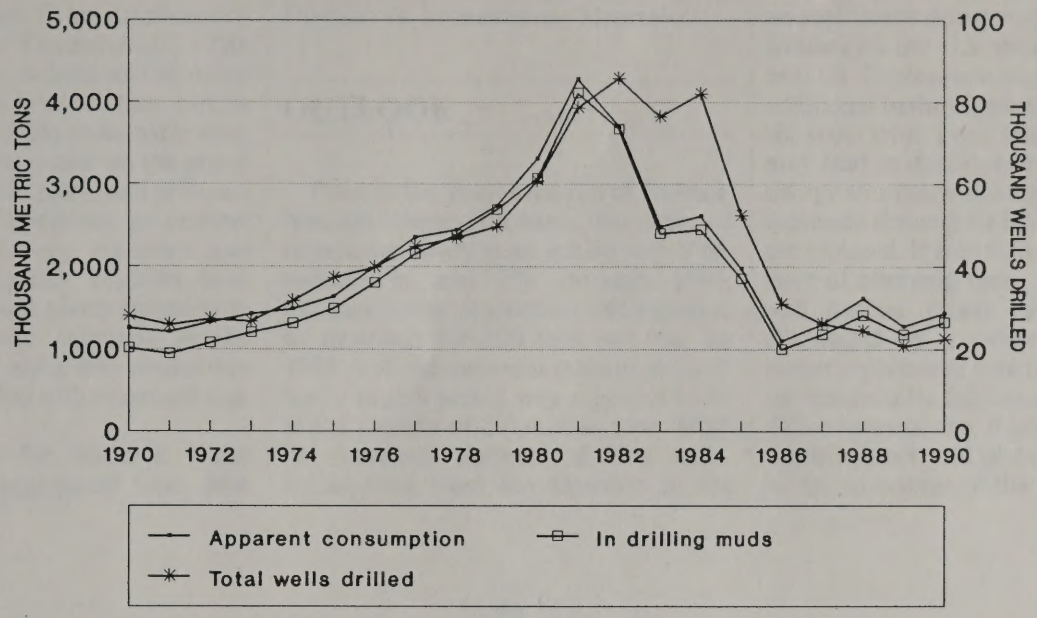


TABLE 5

CRUSHED AND GROUND BARITE[1] SOLD OR USED BY PROCESSORS IN THE UNITED STATES, BY USE

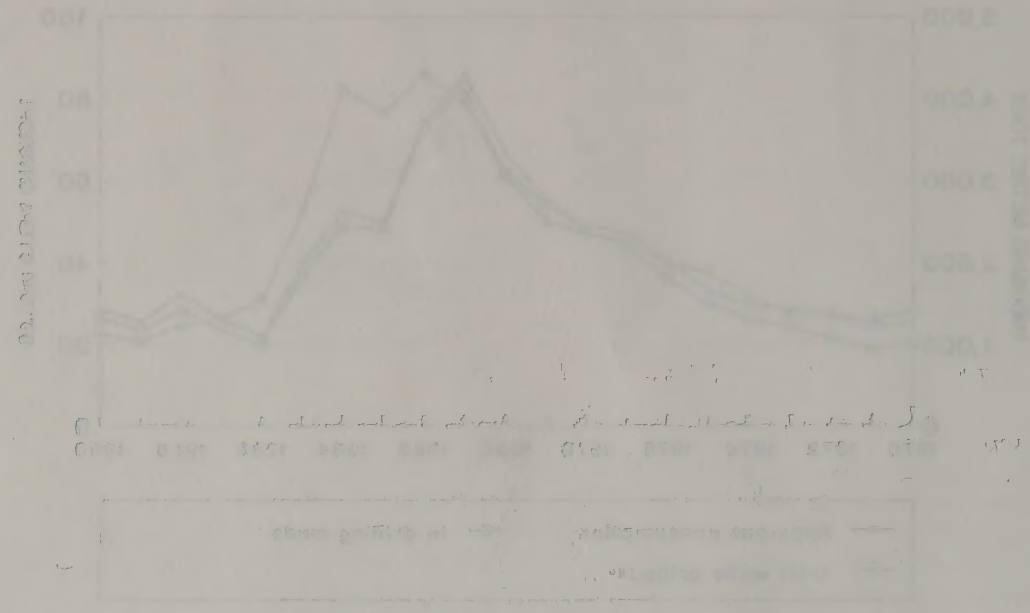
(Thousand metric tons and thousand dollars)

Use	1989		1990	
	Quantity	Value	Quantity	Value
Barium chemicals, filler and/or extender, glass	140	19,470	105	16,758
Well drilling	1,137	84,289	1,329	107,078
Total	1,277	103,759	1,434	123,836

[1]Includes imports.

grade ore, foreign or domestic, to meet American Petroleum Institute specifications for 4.2 drilling-mud-grade barite. Most of the crude barite entered through customs districts along the gulf coast for delivery to grinding plants in the area. The import distribution by customs districts in 1989 (1988) was New Orleans, LA, 73% (65%) and Houston, TX, 24% (31%). Small amounts were also received, in decreasing order, in Laredo, TX; Portland, ME; Pembina, ND; Detroit, MI; Savannah, GA; and Buffalo, NY.

Imports of ground barite increased to about 57,000 tons from about 47,000 tons in 1989; of this, Canada (16%), China (5%), Mexico (65%), and Morroco (13%) supplied almost all of the total. Prior to 1984, ground barite imports had been limited to premium-quality pharmaceutical grades, which were unavailable domestically. In recent years, this market has been dwindling because certain medical X-ray diagnostic procedures employing barium compounds have been largely replaced with computer-assisted tomography (CAT) scanners or imaging techniques. Sources of medical-grade barite were Canada, the Federal Republic of Germany, Japan, and the Netherlands. The average c.i.f. value of lower grade imports ranged from $36 to $309 per ton, suggesting that most of this ground barite is probably destined for the domestic filler and/or extender markets that usually are supplied by U.S. producers. The continued imports of ground filler- and extender-grade barite into this mature market will probably cause concern among domestic producers. Imports



for consumption of barium chemicals decreased slightly.

World Review

The data in table 13 are rated capacity for mines as of December 31, 1990. Rated capacity is defined as the maximum quantity of product that can be produced on a normally sustainable long-term operating rate, based on the physical equipment of the plant, and given acceptable routine operating procedures involving labor, energy, materials, and maintenance. Capacity includes both operating plants and plants temporarily closed that, in the judgment of the author, can be brought into production within a short period with minimum capital expenditure.

Mine capacity for domestic barite production was aggregated from data voluntarily supplied by the producers. The rated capacity data for the foreign mines were estimated from the previous year's production in cooperation with the Division of International Minerals.

OUTLOOK

Prior to the Iraqi invasion of Kuwait, domestic demand for barite was expected to increase slowly at an annual rate of between 1% and 2% through 1995. Primary barite production was expected to approach 500,000 tons per year by 1995, and the apparent consumption of barite in this period was expected to be in the vicinity of 2.0 million tons. With the increased domestic drilling activity resulting from the situation in the Persian Gulf area, demand may grow quicker than previously had been anticipated.

Although oil supplies have experienced no significant disruptions, attention has focused on the U.S. dependence on foreign oil. Exploration activities requiring additional barite supplies are expected in the short term. Long-term investigations may lead to development of alternative energy sources, ultimately resulting in a decreased demand for barite as oil and gas are replaced. It is anticipated that acceptance of alternate fuels, such as alcohol and nuclear power systems, will be challenged by a belatedly introduced newer and cleaner generation of petroleum products by the major oil companies. These two systems, if left to competitive market forces, will probably be resolved to the advantage of the new generation

TABLE 13

BARITE: WORLD PRODUCTION, BY COUNTRY[1]

(Metric tons)

Country[2]	1986	1987	1988	1989	1990[e]
Afghanistan[e 3]	2,000	2,000	2,000	2,000	2,000
Algeria[e]	[4]60,000	60,000	60,000	60,000	60,000
Argentina	58,617	33,462	r48,972	r57,558	50,000
Australia	5,818	10,363	10,970	e10,000	11,000
Belgium[e]	40,000	40,000	35,000	40,000	40,000
Bolivia	129	1,337	—	r([5])	600
Brazil	r105,489	r158,197	r58,278	r51,407	65,000
Burma[6]	r11,578	r17,243	r12,678	r9,144	9,000
Canada	40,000	42,000	51,000	r39,000	[4]48,000
Chile	53,121	52,109	43,135	r59,873	[4]3,037
China[e]	1,000,000	1,250,000	1,500,000	1,750,000	1,750,000
Colombia	4,198	4,189	e4,000	r5,460	5,400
Czechoslovakia[e]	60,000	60,000	r[4]60,794	60,000	60,000
Egypt	e4,500	4,116	5,651	r7,295	7,000
Finland	6,969	11,000	r10,993	r1,614	1,500
France	116,400	104,050	e100,000	e100,000	100,000
Germany, Federal Republic of:					
Western states	201,565	173,356	r165,317	r144,106	144,000
Eastern states[e]	34,000	32,000	32,000	30,000	27,000
Greece[7]	2,305	2,227	2,300	r1,180	1,150
Guatemala	750	—	2,415	r3,995	4,000
India	344,000	247,000	r445,604	r548,103	475,000
Iran[3]	r42,430	r44,309	r59,660	r45,000	45,000
Ireland	127,500	70,000	83,000	r82,000	85,000
Italy	114,132	81,643	85,650	r75,640	75,500

See footnotes at end of table.